Patent Application of Donald Onken, Tim McDonough, J.J. Richardson, and Steve Stone

[0001]   SENSING DEVICE FOR MONITORING CONDITIONS AT A REMOTE LOCATION AND METHOD THEREFOR

[0002]   PRIORITY

[0003]   This is a Continuation-in-part of S.N. 09/432,498, filed November 2, 1999, which is a non-provisional application of provisional patent application, S.N. 60/113,466, filed December 23, 1998, and is also a continuation-in-part of S.N. 10/350,001, filed January 24, 2003, which in turn is a continuation of S.N. 09/432,498.

[0004]   INCORPORATION BY REFERENCE

[0005]   The MICROFICHE APPENDIX that was attached to S.N. 09/432,498 for the software program submission is incorporated by reference herein. The MICROFICHE APPENDIX included a page of microfiche containing 35 frames.

[0006]   FIELD OF THE INVENTION

[0007]   The present invention is directed to a sensing device for monitoring conditions at a remote location and a method therefor. Particularly, the instant invention is for a sensing device that monitors the conditions of a container at a remote location and a method therefor. More particularly, the disclosed invention is for a sensing device that

monitors the level of waste materials in a waste disposal container at a remote location and, then, relays this information to allow for the emptying of the waste disposal container.

[0008] BACKGROUND OF THE INVENTION

[0009] The amount of trash is an ever-growing problem. This is especially true in the retail and commercial sectors, where a large amount of refuse is discarded daily. Most businesses have trash bins adjacent to their buildings for dumping the totality of trash collected either daily or throughout the day. The rate at which the garbage piles up in these trash receptacles varies according to factors such as the season, the industry, the location, etc. Consequently, different businesses and different locations of a business may require different pick-up times for their trash bins.

[0010] To minimize the cost of hiring commercial trash collection services to pick-up the trash from the trash receptacles, some companies may designate standard pick-up times, such as daily or weekly, even though the trash bins may not be full. Other companies may call commercial trash collection services only when their trash bins are full. Either way, the company usually must use the telephone to call the commercial trash collection service.

[0011] The detection of the level of trash in trash receptacles is known in the art. Such detection usually entails some device or method used within the receptacle that

senses the level of trash. For instance, a photoelectric cell has been employed for this purpose, as described in U.S. Pat. No. 3,765,147 to Ippolito. Another variation measures the pressure exerted on the trash compactor to detect when the receptacle is full, as disclosed in U.S. Pat. No. 4,773,027 to Neumann. Still, U.S. Pat. No. 3,636,863 to Woyden teaches using pressure-sensing means to determine when the trash container is full.

[0012] Additionally, it is known in the art to utilize a means for relaying the information regarding the fullness of the trash receptacle to another location, where the information can be processed. Usually, this relaying method encompasses a telephone or cellular phone line. Some of these devices include U.S. Pat. No. 5,558,013 to Blackstone, Jr.; U.S. Pat. Nos. 5,299,493 and 5,303,642 to Durbin et al.; U.S. Pat. No. 5,214,594 to Tyler et al.; and U.S. Pat. Nos. 5,173,866 and 5,016,197 to Neumann et al.

[0013] Continuing with the prior art, there are many other private and commercial applications for transferring electronic data from one location to another that are impractical when the transmission involves the use of conventional telephone modems, permanent data connections, or Internet access. These applications would benefit from data transfer capability but the ongoing cost associated with a traditional Internet connection or a long distance toll phone call makes the feature uncompetitive from a financial standpoint.

[0014] There are several common techniques that are presently used to effect data transfer.

[0015] On common technique is that a computer or other electronic device equipped with a modem places a call to a second computer, also equipped with a modem. The second computer's modem detects the incoming call, answers, and the two modems facilitate maintaining a connection through the phone system that allows data transfer. This connection remains until one of the two computers terminates the call. The disadvantage of this method is that for the duration of the connection the user is charged for either local units of connect time, long distance toll charges, or both.

[0016] Another common technique is that a computer or other electronic device may be permanently connected to the Internet via dedicated modem, DSL (Digital Subscriber Line), or other types of permanent connections leased through the telco or an Internet Service Provider (ISP.) When one computer transfers data to another a transport protocol such as TCP/IP in conjunction with other Internet infrastructure services sends one or more packets of data containing the desired information. The disadvantage of this method is it incurs recurring fees from the ISP and may add a level of complexity and cost to the remote device that makes it impractical.

[0017] Still further technique is the use of the features of a commercial telephone service known as Automatic Number Identification (ANI) commonly referred to as Caller ID in conjunction with the suitable process algorithms wherein it is possible to economically transfer data to and from a remote location without requiring either a permanent connection or completing a call through the switched telephone system that will incur any per unit charges.

[0018]   When a person or device causes a telephone call to be placed to a specific telephone number the telephone company's (telco) ANI system encodes the unique originating telephone number and a short message identifying the caller on the ring signal that goes to the receiving telephone number. This information may be decoded by any number of commercial "Caller ID" devices and presented at the receiving location on a visual display or as data that can be interpreted and processed by a computer.

[0019]   Historically this Caller ID information has been used to allow a person or machine at the receiving location to identify the calling location before answering the call. This information is typically used to determine if the call should be accepted; whether or not the caller is authorized to connect to a specific computer; retrieve customer account information prior to answering the call; or to automatically route inbound calls to a particular phone extension. It is common practice in many private residences to use this feature to effectively screen incoming calls and to decide whether or not to answer the telephone based on the identity or location of the caller. However, this technique has not been used to transfer data without the completion of a telephone call.

[0020]   Still further, there is some prior art which makes use of the conventional Automatic Number Identification (ANI, also commonly called CALLER ID) feature of a commercial telephone service to convey data between two locations using coding/decoding techniques and without the need for the completion of a telephone call between the two stations. Ayoub et al. (EP 0,944,229) and Savery et al. (U.S. 6,085,097) each refers to the

broad concept of communicating information between two stations without the need for the completion of a telephone call. However, each shows the use of a multitude of telephone lines, one line being assigned to one particular state or condition. Thus, if 10,000 bits of information is to be conveyed, the system and technique in each publication requires 10,000 lines. Furthermore, EP '229 discloses an alternative scheme of generating different tones (length or duration) to represent different bits of information. Another patent, Ayoub et al. (6,477,363) discloses substantially the same as EP '229. Savery (EP 0,963,088) discloses a network where a sending device converts the information into a length of time of ringing and causes the receiver (at another location) to ring for that length of time. The receiver converts the length of the ringing back to the information sent. In all these references, either a multitude of lines, each uniquely assigned to a particular bit of information, or an information bit-to-tone conversion system is needed. Our system and technique does not require such an arrangement. In other words, the number of digital bits of information transmitted and received, and the number of telephone lines available to transmit and receive the bits do not require a one-to-one correspondence, i.e. they are independent of each other.

[0021]   While each of these systems is useful, they are burdened by several significant disadvantages: First, they fail to minimize the expenses of telephone toll charges when transmitting information regarding the trash receptacles via a telephone line. This charge may be quite expensive, in light of the fact that some systems maintain a multitude of trash containers. Second, they do not allow users to measure the amount of

power supply left in the transmitting means. If the power supply runs out, the waste disposal detection system would be rendered useless. Third, the references do not disclose a way to conserve energy and, thus, allow one to save on more expenses. And, since these references fail to conserve energy, they are not optimally environmentally friendly. Fourth, the references do not disclose a means to verify that the measurements of the waste disposal container are valid, thereby preventing false readings which may also result in unnecessary charges in emptying a container that is not completely full.

[0022]   BRIEF SUMMARY OF THE INVENTION

[0023]   The instant invention is for a sensing device that may be used for detecting various conditions at remote locations. In particular, one embodiment of the invention is directed to a sensing device for detecting the conditions of a container at a remote location. Another embodiment would be used to detect conditions in a waste disposal container at a remote location.

[0024]   Generally, this invention features three main components: a transmitting module, a receiving module and an identifying means. While each transmitting module is paired with one base module, each base module may be matched with a multitude of transmitting modules at any one remote location to accommodate the number of containers at that location. Moreover, there may be numerous remote locations comprising such pairings.

[0025] The invention also comprises a detecting means for detecting the conditions at the remote location. The detected information is sent to the transmitting module, which has a reading means and a transmitting means. The reading means reads the detected information. In practical usage, the transmitting module also has a first power source for supplying power thereto. The first power source has a power level that is also read by the reading means. The transmitting means sends the information pertaining to the conditions of the remote location and the power level of the first power source to the base module, which is located near the transmitting module. Advantageously, the transmitting module is only turned-on for approximately 10 seconds, during which time it completes all of its functions. This results in substantial savings in energy charges and is environmentally-friendly.

[0026] The base module comprises a receiving means, a first processing means and a conveying means. The receiving means receives the transmitted information from the transmitting module and, then, sends the information to the first processing means of the base module. In one embodiment of the present invention, information from containers located at a close proximity to the base module may be sent directly to the first processing means, without utilizing a transmitting module. Additionally, the base module may have a second power source whereby the power level of this power source is also sent to the first processing means. The first processing means selectively processes all of the information it receives to determine which of a list of pre-programmed telephone numbers to call. In other words, each telephone number matches-up with each of the conditions of

the remote location, the amount of power supply in the first and second power sources, and the conditions of the containers located at a close proximity to the base module. The conveying means relays the transmitted information by calling the selected telephone number.

[0027]   An identifying means is used to identify the remote location of the call. This is typically accomplished by identifying the originating telephone number of the remote location. In the most preferred embodiment, the identifying means identifies the data being transmitted in as little time as possible. This is accomplished through the use of a second microprocessor having a CALLER ID unit that can identify the location of the originating call without having to "answer" or "connect" the call. Once the originating telephone number of the remote location is identified, one embodiment of the invention would allow for the container or trash receptacle at the remote location to be emptied or for the power level of the first power source to be recharged.

[0028]   Another embodiment of the present invention is a method of monitoring the conditions at a remote location. Two other embodiments of the invention include: (1) a method for remotely monitoring the conditions of a container; and (2) a method for remotely monitoring the conditions of a trash receptacle.

[0029]   It is, therefore, an object of the present invention to teach a means for alleviating the problems associated with the prior art systems of trash receptacle detection.

[0030] It is an object of the instant invention to provide a sensing device for monitoring conditions at a remote location and a method therefor.

[0031] It is also an object of this invention to provide a sensing device for monitoring the conditions of a container at a remote location and a method therefor.

[0032] It is another object of the present invention to provide a sensing device for monitoring the conditions of a waste disposal container and a method therefor.

[0033] A further object of this invention is to provide a sensing device that transmits its data in as little time as possible, and a method therefor.

[0034] It is also an object of the instant invention to provide a sensing device that measures the power supply of the transmitting means and a method therefor.

[0035] Another object of the present invention is to provide a sensing device that conserves the consumption of energy used by the device and a method therefor.

[0036] It is a further object of this invention to provide a sensing device that is environmentally friendly and a method therefor.

[0037] It is an object of the present invention to provide a means to verify the information regarding the conditions of a container.

[0038] It is further an object of the present invention to accomplish the transfer of the needed data between the transmitting and the receiving stations utilizing a number of telephone lines less than that required by the previous systems and techniques.

[0039] There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and that will form the subject matter of the invention. Those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other devices for carrying out the several purposes of the present invention. It is important, therefore, that the invention be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present disclosure.

[0040] BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0041] The foregoing and other additional objects of the present invention will be readily appreciated by those skilled in the art upon gaining an understanding of the

invention as described in the following detailed description and shown in the accompanying drawings in which:

[0042] FIG. 1 is a block diagram illustrating the generalized embodiment of the sensing device of the present invention.

[0043] FIG. 2 is a flow diagram showing the steps of the general embodiment of the method of monitoring conditions at a remote location of the present invention.

[0044] FIG. 3 is a schematic block diagram displaying another embodiment of the sensing device of the present invention in which the conditions of a container are monitored by the sensing device.

[0045] FIG. 3A1-A2 show details of the transmitting module.

[0046] FIG. 3B1-B3 show details of the base module.

[0047] FIG. 4A is a flow diagram of one embodiment of the method of monitoring conditions of a waste disposal container at a remote location and matching the conditions to a telephone number.

[0048]   FIG. 4B is a flow diagram of one embodiment of the method of monitoring

conditions of a waste disposal container located at a close proximity to the base module

and matching the conditions to a telephone number.

[0049]   FIG. 4C is a flow diagram of one embodiment of the method of calling the

telephone number matched in FIGS. 4A & 4B and conveying information regarding the

monitored conditions.

[0050]   FIG. 5 is a block diagram illustrating the data transfer between a remote

location and a primary location using only two telephones at the primary location.

[0051]   FIG. 6 is a flow chart depicting a single bit or element of data being encoded

and transmitted.

[0052]   FIG. 7 is a flow chart depicting a single bit or element of data being received

and decoded.

[0053]   FIG. 8 is a block diagram illustrating one embodiment of the conserving

means used in the transmitting module.

[0054]   FIG. 9 is a flow diagram showing the process of conserving the power level

of the first power source in the transmitting module.

[0055]   FIG. 10 is a block diagram illustrating one embodiment of the off-hook detecting means used in the base module.

[0056]   DETAILED DESCRIPTION OF THE INVENTION

[0057]   Referring to the drawings, FIG. 1 shows a block diagram of four sensing devices **10** of the instant invention. Each sensing device **10** comprises, generally, detecting means **14**, a transmitting module **18**, a base module **22** and identifying means **26**. The detecting means **14** and the transmitting module **18** are located at a remote location **12** (shown as dotted rectangular areas in FIG. 1). The detecting means **14** detects conditions at the remote locations 12. Lines 16 show that the detected information is sent to a transmitting module **18**. The transmitting module **18** reads the information before transmitting the information, shown by dotted-line **20**, to a base module **22**.

[0058]   When the base module **22** receives the transmitted information, it processes the information to determine which number from a database **136** of pre-programmed telephone numbers to call (shown as step **38** in FIG. 2). This call is shown by line **24**, which also shows the information being conveyed to the identifying means **26**. As FIG. 1 depicts the general embodiment of this invention, other embodiments will be apparent in the following descriptions of the relevant figures. For instance, since the identifying means **26** necessarily identifies the remote location **12** of the call by identifying a telephone number, it follows that each remote location **12** must have its own originating telephone

number. Also, even though only one identifying means **26** is show in FIG. 1, it will be shown *infra* that there most likely comprises a multitude of identifying means **26** to match-up with the host of different conditions processed by the base module **22**.

[0059]   FIG. 2 is a flow diagram depicting the generalized method for monitoring conditions at a remote location **12**. Step **28** detects the conditions at the remote location **12**. Step **30** reads the detected conditions. Next, the information regarding the detected conditions are transmitted by step **32** and received by step **34**. The information is processed by step **36** to determine which pre-programmed telephone number to call. Step **38** calls the selected pre-programmed telephone number, while step **40** conveys the transmitted information. The remote location **12** of the call is, then, identified by step **42**. In this embodiment, steps **30** and **32** occur in the transmitting module **18**; steps **34** to **40** occur in the base module **22**; and step **42** occurs in the identifying means **26**.

[0060]   Another embodiment of this invention is shown in FIG. 3, in which a sensing device **10** monitors the conditions of a container **44** at a remote location **12**. The container **44** may be any type of container that holds materials, such as liquids or solids. The conditions of the container **44** include whether the container **44** is full or empty, the level of the contents **45** in the container **44**, or any other condition that the user needs to monitor. A detecting means **14** is used to analyze the conditions of the container **44**. Detecting means **14** that are compatible with the instant invention include conventional detecting means **14** disclosed in U.S. Pat. Nos. 3,765,147, 4,773,027, and 3,636,863 (cited

above). Preferred detecting means **14** include switch inputs **88** and ultrasonic ranging units **130**. The most preferred ultrasonic ranging units **130** comprise units made by Polaroid.

[0061]   But, the most preferred detecting means **14** are switch inputs **88**. The switch inputs **88** of this embodiment are connected by wires **47**, also called hard wire inputs, to the container **44**. The contents **45** inside of the container **44** are typically oil and grease. A float is placed on top of the contents **45** whereby the float is connected to a first end of the wires **47**. The second end of the wires **47** is connected to the switch inputs **88**, which are themselves secured in the transmitting modules **18**. In operation, the float will rise and fall depending on the level of the contents **45** in the container **44**, and this information will be sent to the switch inputs **88**. Each switch input **88** matches with a condition of the container **44**. The preferred embodiment would utilize three switch inputs **88** to indicate whether the container **44** is 3/4 full (input 3 **88c**), ½ full (input 2 **88b**) or 1/4 full (input 1 **88a**). If the container **44** is empty, none of the switch inputs **88a-88c** will be activated.

[0062]   A further embodiment of the present invention illustrated in FIG. 3 and FIG. 3A is a first power source **50**, such as a battery that provides power to the transmitting module **18**. The first power source **50** has a power level that can be measured by a measuring means to determine when it is low and, thus, needs to be recharged or changed. A first power source **50** that may be used with this invention is a battery supply **50**, most preferably a 9-volt battery.

[0063] The information regarding the conditions of the container **44** is sent by the detecting means **14** to the reading means **46** of the transmitting module **18**. The reading means **46** reads both the information from the detecting means **14** and the power level 2 of the first power source **50**, and transfers the information to the transmitting means **54**. The preferred reading means **46** comprises a combination of at least one transistor **56**, at least one resistor **58** and an encoder **60** per switch **88**, when a preferred switch input **88** is used. The transistor **56** conveys high and low switch information to the encoder **60**, and the resistor **58**, along with a capacitor **61**, limits the current to protect the transistor **56** from damage and noise/static. It is preferred that the transistor **56** comprises a 2N3904 transistor **56**. The resistors **58** comprise 10 kilo-ohm resistors **58a**, while the capacitor **61** comprises a 0.1 microferad-50 volt ceramic capacitors **61**. In another embodiment of the instant invention, a measuring means **62** is used to measure the power level of the first power source **50**. Thereafter, the measuring means **62** also conveys the power level information to the encoder **60**. It is further preferred that the encoder **60** comprise an encoding integrated circuit (IC). The most preferred encoder **60** is a Holtek Encoder HT-12E that is commercially available. The measuring means **62** is preferably one half of an operational amplifier (OpAmp) circuit **64**, a plurality of resistors 59 and a voltage reference **65**. The most preferred OpAmp circuit **64** comprises a model LM2903 OpAmp circuit. The preferred resistors 59 used in the measuring means **62** comprise a 10 kilo-ohm resistor 59a, a 100 kilo-ohm resistor 59c and a 7.5 kilo-ohm resistor 59b. The most preferred voltage reference **65** comprises a 2.5 volt voltage reference having model number LM285-2.5.

[0064]   Still referring to the same embodiment in FIG. 3 and FIG 3A, a delaying means 66 may be used to delay the encoder 60 from transmitting the data until all the circuitry of the encoder 60 is powered up and stable. The delaying means 66 is preferably the other half of the OpAmp circuit 64 described above used in conjunction with a plurality of resistors 69 and a capacitor 61. The most preferred OpAmp circuit 64 comprises the model LM 2903 OpAmp circuit identified above. The plurality of resistors 69 most preferably comprises two 10 kilo-ohm resistors 69a and one 100 kilo-ohm resistor 69c. It is also preferred that the capacitor comprises a 0.1 microferad capacitor 63.

[0065]   Another embodiment of the transmitting module 18 depicted in FIG. 3 is a conserving means that is used to conserve the power level of the first power source 50. Preferably, the conserving means comprises an activating means 70 that only activates the first power source 50 of the transmitting module 18 at periodic intervals. The most preferred activating means 70 comprises a slow timing circuit 72 that is shown in more detail in FIGS. 8 and 9 and is discussed *infra*.

[0066]   Still referring to FIG. 3 and FIG. 3A, the transmitting means 54 preferably comprises an encoder 60, which is most preferably the same encoder 60 used for the reading means 46. The encoder 60 transmits data over an RF link 256, shown by line 20, to the base module 22. This is accomplished by using an AM transmitting unit 74 or an FM transmitting unit 76. Preferably, the AM and FM transmitting units 74 and 76 may comprise the AM-RT4-433 unit 74 or the TXM-433-A unit 76, respectively, both manufactured by

Abacom Technologies. Each bit of information transmitted by the transmitting means **54** represents one condition. For instance, information pertaining to the three different levels of the container **44**-- that is, 3/4 full, ½ full and 1/4 full-- and the power level of the first power source **50** comprise four conditions which represents 4-bits of information.

[0067]   Next, referring to FIG. 3 and FIG. 3B, the receiving means **78** of the base module **22** receives the transmission from the transmitting means **54**. In particular, the receiving means **78** comprises a receiver **80** and a decoder **82**. In operation, the receiver **80** receives the data sent from the transmitting means **54** and conveys the data to the decoder **82**. The receiving means **78** is preferably an RF receiving unit so that it can receive transmissions over the RF link **256**, shown by line **20**. The preferred receiver **80** comprises either an AM receiver **80a** or an FM receiver **80b**, most preferably either the AM-HRR3-433 receiver or the SILRX-433-A receiver, respectively, both manufactured by Abacom Technologies. The decoder **82** is preferably a Holtek decoder **82**, most preferably the HT-12D unit.

[0068]   Dip switches may be used in both the transmitting module **18** and the base module **22** to change the addresses, respectively, of the encoder **60** and the decoder **82**. This allows for multiple pairings of transmitting modules **18** and base modules **22** at the same remote location **12**, shown in FIG. 1, which results in the detection of a number of containers **44** at the same location **12**. The binary address of a transmitting module **18** is matched with the binary address of a base module **22** so that the two modules **18** and **22**

may communicate with each other. The most preferred dip switches are four-position dip switches **178** because they allow for sixteen different addresses to exist at a single location **12**. Preferred four-position dip switches **178** are C&K-BD04 dip switches. It is further preferred that the transmitting module **18** and the base module **22** not be farther than 300 feet apart.

[0069] The decoder **82**, then, conveys the received data to the first processing means. Preferably, the first processing means comprises a first microprocessor **86**. The most preferred first microprocessor **86** is the Atmel AT89S8252 microprocessor **86**. A rapid timing circuit **346** is used in conjunction with the first microprocessor **86** to constantly activate the first microprocessor **86**. The rapid timing circuit **346** preferably comprises a rapid oscillator **206a** and two capacitors 84. The preferred rapid oscillator **206a** comprises a crystal oscillator, most preferably an 11.0592 mega-hertz xtal oscillator. The preferred capacitors **84** comprise 33 picofarad ceramic capacitors.

[0070] It is further preferred that the base module **22** has six switch inputs **88** (discussed *infra*) and transferring means **90**, whereby the six switch inputs **88a-88f** convey high/opened and low/closed switch information to the transferring means **90** which, then, conveys that information to the first microprocessor **86**. As discussed *supra*, three **88a-88c** of the six inputs **88a-88f** may match-up with the level of the contents in a container, while the other three inputs **88d-88f** may match up with other conditions, such as the level of contents in other containers. If a switch input **88** is in the high/opened state, then the first

microprocessor **86** will not match the condition with a telephone number. But, if a switch input **88** is in the low/closed state, then this is considered an "active" state and the first microprocessor **86** matches the appropriate telephone number with the condition to prepare for that number to be dialed (shown in FIG. 4B). The transferring means **90** protects or buffers the external surroundings from the inputs **88** to the first microprocessor **86** to prevent interference therefrom. The preferred transferring means **90** is an inverter, the most preferred inverter being a trigger inverter. The most preferred trigger inverter is a Schmidt trigger inverter IC **U6** having model number 74HC14.

[0071]   The base module **22** is powered by a second power source **98**. The second power source **98** is preferably a transformer, most preferably a wall transformer **102** having a 12 volt DC output, such as the 12 volt-500ma DC - CUI STACK#DPD120050-P-5 wall transformer. The wall transformer **102** feeds power, sequentially, to a power input jack **104**, a full wave bridge circuit **106** and a regulator **108**. The regulator **108**, then, feeds power to the rest of the internal circuitry of the base module **22**. The full wave bridge circuit **106** allows any polarity of DC input to power the base module **22** and is, most preferably, a full wave bridge circuit **106** made up of four 1N4004 diodes **107**. The regulator **108** is most preferably a 5-volt regulator **108**, such as the 7805-voltage regulator unit, that converts the incoming 12 volts DC from the wall transformer **100** to a lower power level of 5 volts.

[0072]   As a precaution against losing the operating program (disclosed in the MICROFICHE APPENDIX incorporated herein from the parent, S.N. 09/432,498, or from the continuation thereof, S.N. 10/350,001) that is running the first microprocessor **86**, there is a watchdog IC **114** that generates a reset pulse to restart and power-up the first microprocessor **86**. To prevent the watchdog IC **114** from generating the reset pulse, it is preferable to utilize a strobe input in the watchdog IC **114** that is periodically strobed or toggled by the first microprocessor **86**. While the strobe input is toggled, the watchdog IC **114** will not generate a reset pulse. But, if the first microprocessor **86** stops toggling the strobe input, the watchdog IC **114** will, after a set time period, generate a reset pulse to restart the first microprocessor **86**. The most preferred watchdog IC **114** is the Maxim MAXCPA1232uP supervisor unit.

[0073]   Continuing with FIG. 3 and FIG. 3B, the base module **22** preferably has at least one external first-indicator **120** and means for turning on the first-indicator **120**. The first-indicator **120** allows human operators to supervise the conditions of the base module **22** by connecting the first indicator **120** to the first processing means of the base module **22**. The means for turning on the first indicator **120** most preferably comprises at least one transistor **124**, while the first-indicator **120** comprises at least one lamp. The most preferred lamp is at least one light emitting diode (LED) **174**. In the most preferred embodiment, the first processing means relays data to the transistors **124** which lights the light emitting diodes 174, thus alerting operators on the scene of any problems. The preferred transistors **124** comprise MPS-A18 transistors. The first-indicator **120** can be

used to alert operators regarding the different conditions of the remote location **12**, the transmitting module **18** or the base module **22**, depending on the preference of the user. The most preferred conditions indicated comprise: the low power level of the second power source **98** of base module **22**; the different levels of the containers **44**; telephone dialing in progress; the low power level of the first power source **50** of the transmitting module **18**; and that valid data has been received from the transmitting module **18**.

[0074]   At least one second indicator **194** shown in FIG. 3B may be used to supplement the first-indicator **120**. The second indicator **194** is most preferably also an LED. The specific process encompassing this embodiment is discussed *infra* and illustrated in FIG. 4B. In the preferred embodiment, the first indicator **120** is a light source that can be seen from a distance to alert operators of potential problems, while the second indicator **194** is an LED **175** on the base unit **22** that can be viewed at a close range thereto. Additionally, multiple first indicators **120** and second indicators **194** may be utilized to indicate different conditions, a sample of which is illustrated in FIG. 4B and its corresponding discussion *infra*. The most preferred LEDs **175** used for the second indicators **194** comprise size T-1 LEDs **175**. Resistors **58b** may be used in series with the LEDs **175** to limit the current running through the LEDs **175**. Preferred resistors comprise 470-ohm resistors **58b**.

[0075]   The base module may also have reporting means **128** that report conditions at a close proximity to the base module **22**. FIG. 3 and FIG.3B illustrates the reporting

means **128** reporting the conditions of a container **44** located near the base module **22**. The reporting means **128** operates in the same manner as the detecting means **14** described above. As such, the reporting means **128** may comprise any of the types of devices discussed for the detecting means **14**. But, the most preferred reporting means **128** are switch inputs **88** shown in FIG. 3B. However, alternatively, ultrasonic ranging units **130** shown schematically in FIG 3 can be used. Either way, the reporting means **128** utilizes wiring **47** to send data from the container **44** to the first processing means **84** of the base module **22**. The preferred wiring **47** is hard wire inputs. If an ultrasonic ranging unit **130** is used as the reporting means **128**, it would use the first microprocessor's **86** internal timing functions to measure the time it takes for an ultrasonic pulse to travel from the top of a container **44** to the contents **45** therein and, then, back to the top to compute the level of the contents **45** in the container **44**. The most preferred ultrasonic ranging units **130** comprise units made by Polaroid. However, if the switch inputs **88** are used, they would be used in the same manner as described above for the detecting means that is, with a float placed on top of the contents **45** within the container **44**. Most preferably, each of the switch inputs **88a-88f** are connected to connectors to facilitate external connections to the reporting means **128**. The preferred connectors comprise dual row 12-pin right angle "Molex Microfit" connectors.

[0076]   The conveying means **134** of the base module **22** conveys the data processed by the first processing means **84** to the identifying means **26**, as shown by dotted line **24**. It accomplishes this by calling the telephone number determined by the first

processing means **84** which matches each condition with an appropriate telephone number, as selected from a list of pre-programmed telephone numbers, identified in FIG. 3 as a pre-programmed telephone number database **136**. The database **136** is ideally stored in non-volatile memory **138** inside the first microprocessor **86**. The selection of the appropriate telephone number by the first processing means **84** is accomplished by the novel software program attached to the parent application, S.N. 09/432,498, or from the continuation thereof, S.N. 10/350,001, as disclosed in the MICROFICHE APPENDIX and is incorporated herein. The MICROFICHE APPENDIX and FIGS. 4A-4B also disclose the process by which the appropriate telephone number is selected.

[0077]   Still referring to the conveying means **134**, it preferably comprises a microprocessor, most preferably the first microprocessor **86** used for the first processing means **84**. The microprocessor is connected to a modem **142** and an operating program. Modems **142** are commercially available, but the preferred modem **142** is a Cermetec modem having part number 1786LC.

[0078]   Another component of the conveying means **134** is telephone lines **146** (shown in FIG. 10) used to convey the data. When telephone lines **146** are used, one of skill in the art will know to use telephone jacks **148** (shown in FIG. 10) in the base module **22** for connecting the telephone lines **146** to the base module **22**. The most preferred telephone jacks **148** comprise Corcom RJ11-2L-S telephone jacks **148**. It is to be understood that cellular telephones may be used as a substitute component for telephone

lines **146**, in which case modems **142** adapted for use with cellular telephones are required, along with other devices known in the art for utilizing cellular telephones. Thus, line **24** depicts data transmissions by either telephone lines **146** or cellular telephones. FIG. 10 illustrates an off-hook detecting means **348** that detects whether the telephone line **146** is in use (off-hook) or not in use (on-hook) and is described in detail *infra*.

[0079] Updating means may be used to update the information stored in both the pre-programmed telephone number database **136** and the operating program of the microprocessor. The most preferred updating means is a connector. The preferred connector comprises the 9-pin female D-subminiature right-angle board mount "Amp 745781-4" connector.

[0080] Often, electrical noise on telephone lines **146** can damage the circuitry as it travels between the modem **142** and the telephone lines **146**. Protecting means are preferably used to protect the circuitry. Preferable protecting means include additional circuitry in the form of high voltage capacitors **162**, ferrite beads **164**, resettable fuses **166** and surge protectors **168**. The most preferred ferrite beads **164** comprise the "Fair-Rite" 264366611 ferrite bead **164a** or the "Fair-Rite" 2943666661 **164b** ferrite bead. The most preferred resetable fuses **166** comprise Raychem Polyswitch TR600-150 fuses, while the most preferred surge protectors **168** comprise Teccor Sidactor P3203AB surge protectors. When cellular telephones are used as the conveying means **134**, electrical noise is not a problem, such that protecting means are not required.

[0081]   Referring to FIG. 3, the identifying means **26** receives the data sent by the

conveying means 134 of the base module **22.** Specifically, a second processing means

180 having a CALLER ID unit **182** is the preferred identifying means **26.** If the second

processing means **180** is not used, a CALLER ID unit **182** may be used by itself as the

identifying means **26.** Either way, the CALLER ID unit **182** is the component that initially

receives the data sent by the conveying means 134. Preferable CALLER ID units **182**

comprise the "WhozzCalling?Lite4"(TM) and "Whozz Calling?Lite8"(TM) units made by

Zeus Phonstuff, Inc., Norcross, Georgia, that is commercially available. Furthermore, a

printer **184** may be connected to the second processing means **180** so that the data

identified by the identifying means **26** may be printed as a written record. The most

preferred second processing means **180** is a second microprocessor. It is also preferred

that the second microprocessor utilizes a hard drive or a floppy drive (not shown), or most

preferably both, to store data comprising information regarding the location **12** of the

incoming call.

[0082]   Once the identifying means **26** identifies the remote location **12** of the

originating call to the pre-programmed telephone number, and before the receiving means

answers the call, a disconnecting means **186** may be used to disconnect the call, whereby

the information is passed before a call is completed. This results in substantial savings for

the user. The disconnecting means **186** is most preferably located in the base module **22**

and connected to the conveying means **132.** The typical disconnecting means **186**

comprises a modem **142,** preferably the same modem **142** used to call the identifying

means **26** described above. Further, the disconnecting means **186** optimally allows the telephone call to ring for a time period equivalent to four rings before disconnecting the call, so that the identifying means **180** may identify the remote location **12** of the call. The number of telephone rings may vary depending on one's preference.

[0083]   Since the conveying means **132** calls different pre-programmed telephone numbers for different conditions, one can determine from observing the identifying means **26** which condition corresponds with which remote location **12**. As a result, one can send, shown by line **200**, either emptying means **196** or recharging/changing means **198**, or both, to the appropriate remote location **12** or to a location at a close proximity to the base module **22** to remedy the problem. It is most preferable that the second processing means **180** comprise software to make the decision shown by line **200**. This software could also be programmed to print out a report detailing the conditions from the transmitting module **18** and/or the base module **22**. Software that is compatible with the second processing means **180** comprises the "Callwhere(R) Plus for Windows" program made by A&A TeleData, Austin, Texas, that is commercially available.

[0084]   Emptying means **196** may involve using a human operator (not shown) to physically empty the container **44** or it may involve contacting a commercial service (not shown) to empty the container **44**. Recharging means **198** include either recharging or changing the first **50** or second **98** power source.

[0085] FIG. 4 is split into three flow diagrams which, in totality, illustrate one preferred embodiment of the instant invention in which: FIG. 4A illustrates the process of monitoring the conditions of a waste disposal container at a remote location **12**; FIG. 4B shows the process of monitoring the conditions of a waste disposal container at a close proximity to the base module **22**; and FIG. 4C illustrates the process of conveying the conditions monitored by FIGS. 4A and 4B so that appropriate steps are taken to remedy the conditions. Both FIG. 4A and FIG. 4B emphasize the steps of matching the monitored conditions with one of the telephone numbers selected from the list of pre-programmed telephone numbers in database **136**.

[0086] Referring firstly to FIG. 4A, step **238** detects the conditions of the waste disposal container at the remote location **12**. Step **240** measures the power level of the first power source **50**. Step **241** activates the transmitting module **18** using the conserving means. Step **242** reads the information obtained during steps **238** and **240**. Next, the information is encoded by step **244**. Transmission of the information is delayed by step **246** until all circuitry is powered up and stable. Step **248** decides whether all of the circuitry is powered up and stable. If not, line **250** shows that the transmission must be delayed by step **246** until the answer to step **248** is in the affirmative. But, if the answer to step **248** is yes, then line **252** indicates that the information is transmitted by step **254**, which shows the process of transmitting the information over the preferred RF link 256. After the information is transmitted by step **254**, dotted-line **257a** shows that the transmitting module **18** goes to sleep as step **257**. Dotted-line **257b** illustrates that the transmitting module **18** sleeps until it is activated again by step **241**.

[0087]   The transmitted information is received by step **258** and decoded by step **260**. Step **262** shows that the information must be firstly verified, because an initial transmission by the transmitting step **254** may contain a false reading of the level of the contents **45** in the waste disposal container. To prevent the processing of false readings, a second transmission received by the receiving step **258** must contain the same information as the initial transmission for the information to be considered valid. The initial and second transmission-- called consecutive transmissions-- must necessarily occur at five-hour intervals in the preferred embodiment, because the transmitting module **18** is only activated by the activating step **241** every five hours. For example, if, during the initial transmission, the contents **45** in the waste disposal container **236** did not settle, any readings of such information would be inaccurate. Thus, during the second transmission, if the contents **45** have settled, then a different reading would be taken, and the information received from consecutive transmissions of step **254** would not be the same and, hence, would not be firstly verified by step **262**. Consequently, only two consecutive transmissions having the same readings would comprise valid information.

[0088]   Additionally, to further ensure that the information transmitted by step **254** is valid, receiving step **258** disables the base unit **22** for twenty seconds after it receives information from the transmitting module **18**. As a result, no information, whether containing false readings or not, may be received by step **258** during this twenty-second period.

[0089] Continuing with FIG. 4A, step **264** decides whether the transmitting step **254** sent two consecutive transmissions. If not, then line **266** shows that the receiving step **258** is revisited to determine whether more transmissions are forthcoming from step **254**. If the transmitting step **254** does send two consecutive transmissions, at five-hour intervals, then line **268** leads to a series of steps which match a condition at the remote location **12** with a telephone number from the list of pre-programmed telephone numbers in database 136.

[0090] Step **270** decides whether the remote waste disposal container is 3/4 full or more. If so, then line **271a** leads to step **300** which matches ("matching step") that condition with a telephone number. It is important to note that the matching steps **300** disclosed in FIGS. 6A-6C are all typically conducted by the novel software program disclosed in the MICROFICHE APPENDIX attached hereto. If the answer to step **270** is in the negative, line **271b** leads to step **272** to determine whether the remote waste disposal container is ½ full or more. If so, then line **273a** leads to the matching step **300** to match that condition with a telephone number. If the answer to step **272** is in the negative, then line **273b** leads to step **274** to decide whether the remote container is 1/4 full or more. If so, then line **275a** leads to the matching step **300**. If not, then line **275b** leads to step **276**.

[0091] Step **276** determines whether the remote trash container just made a transition from being either ½ or 3/4 full, or more, to being empty. If so, line **277a** leads to the matching step **300**. If not, line **277b** leads to step **278**, which determines whether the

power level of the first power source **50** is low. If the power level is low, line **279a** leads

to the matching step **300**. But if the power level is not low, line **279b** leads to step **280** to

determine whether the transmitting module **18** is responding properly. If the transmitting

module **18** is not responding properly, line **281a** leads to the matching step **300**. However,

if the transmitting module **18** is responding properly, then line **281b** indicates that receiving

step **258** is revisited to prepare to receive another transmission from the transmitting

module **18**. Incidentally, the order of steps **270-280** is not of paramount importance. One

skilled in the art will know that these steps may be arranged in any order to suit one's

preference.

[0092]   Monitoring the transition of the remote trash container from being ½ or 3/4

full, or more, to being empty via step **276** is important because experience shows that

some remote trash containers **44**, may have their contents **45** stolen. It is favorable, then,

for the activating step **241** to be "awakened" immediately in such circumstances so that this

information may be transmitted by step **254**. The quicker activation of step **241** may be

adjusted depending on the user's preference. Thus, once this transition is detected and

received by step **258**, then step **300** matches the appropriate telephone number with this

condition, thereby allowing the steps illustrated in FIG. 4C (discussed below) to convey this

transition. The desired result is to catch potential thieves in the act, or shortly thereafter.

[0093]   Referring now to FIG. 4B, step **282** reports the conditions of any waste disposal containers in close proximity to the base module **22**, and step **284** reports the power level of the second power source **98**. Step **286** decides whether the power level of the second power source **98** is low. If the second power source **98** is at low power, line **287a** will lead to step **300** to match this condition with a telephone number from the list of pre-programmed telephone numbers in database 136. Step **300** is the same as the match step **300** disclosed in FIG. 4A, so it will also be termed the "matching step" **300**. If, however, the power level of the second power source **98** is not low, then line **287b** will lead to step **284** to continue reporting the power level. Steps **284-286** are preferably utilized when the second power source **98** is a battery, since batteries tend to be used up sooner than the power from a transformer **100** (disclosed above).

[0094]   The information reported by step **282** must be secondly verified by step **288**. Step **288** is similar to step **262** (shown in FIG. 4A and its accompanying discussion) in that the former ensures that no false readings are reported by step **282**. However, since step **282** is not subject to the five-hour interval transmissions of step **254** (shown in FIG. 4A), another verifying technique must be utilized. As such, the secondly verifying step **288** is accomplished by the preferred switch inputs **88** staying in the same high/opened or low/closed state for three seconds to allow the contents **45** of the waste disposal container to stabilize or to allow for any electrical noise to be ignored before the information is considered valid. Step **290** determines whether the information reported by step **282** is constant for three seconds. If not, line **291a** returns to step **288** to attempt to verify the reported information. If so, line **291b** shows that the reported information is considered valid.

[0095]   Still referring to FIG. 4B, step **292** determines whether the waste disposal container located at a close proximity to the base module **22** is 3/4 full or more. If so, line **293a** leads to step **294** to light a green **174a**, yellow **174b** and red **174c** light emitting diode ("LED"). The LEDs **174a-174c** disclosed in FIG. 4B provide operators stationed at or near the base module **22** with notice of the level of the trash container located near the base module **22**. Line **295** indicates that once the LEDs **174a-174c** are lit, the condition is matched with a telephone number by the matching step **300**. If the answer to step **292** is in the negative, line **293b** leads to step **296** to determine whether the waste disposal container is ½ full or more. If so, line **297a** leads to step **298** to light the green **174a** and yellow **174b** LED. Then, line **299** leads to the matching step **300**. But if the container is not ½ full or more, line **297b** leads to step **302** to decide whether the trash container is 1/4 full or more. If so, line **303a** leads to step **304** to light the green LED **174a**. Thereafter, line **305** leads to the matching step **300**. If the answer to step **302** is in the negative, then line **303b** leads to step **306** to determine whether the waste disposal container has undergone the transition from ½ or 3/4 full, or more, to empty (as discussed above). If this transition is detected, line **307a** leads to matching step **300**. However, if the answer to the transition step **306** is in the negative, line **307b** leads back to step **282** to restart the reporting process for the waste disposal container at close proximity to the base module **22**. One of skill in the art will know that the color of the LEDs **174a-174c** in the above-described embodiment may be varied according to one's desires and tastes. These descriptions are merely a sample of one of the preferred embodiments of the disclosed invention.

[0096]   Referring to FIG. 4C, matching step **300** is shown to indicate the position where FIGS. 6A-6B leave off and where FIG. 4C begins. After telephone number is matched with the appropriate condition by step **300**, step **308** sends the information comprising the matching telephone number to step **310**, which detects whether the telephone line **146** is on-hook (not in use) or off-hook (in use), discussed *infra* and shown in more detail in a block diagram in FIG. 10. Step **312** is the decision step that determines whether the telephone line **146** is on- or off-hook. If the telephone line **146** is off-hook, the answer to step **312** is in the negative and line **313a** indicates that step **310** is revisited to repeat the off-hook detection. But, if step **312** determines that the telephone line **146** is on-hook, the answer to step **312** is positive and line **313b** shows that the process proceeds to step **314** to call the matched telephone number. Once the telephone number is called, step **316** conveys the information by way of having an originating telephone number that step **318** identifies. Once the originating telephone number has been identified, step **320** disconnects the call. Step **320** most preferably disconnects the call after the fourth ring, or another set time period. All that is required is that the appropriate phone number is identified, which can be done before the call is completed. Thus, the call need not be answered. Thereafter, either one of steps **322** or **324** may take place depending on whether the waste disposal container needs to be emptied (step **322**) or one of the first **50** or second **98** power sources needs to be recharged or changed (step **324**).

[0097]   Additionally, it should be noted that after the call is disconnect by step **320**, the base module **22** prepares to receive information from the transmitting module **18** (step **258** in FIG. 4A) and to report the conditions of the trash container located close to the base module **22** (step **282** in FIG. 4B) and the power level of the second power source **98** (step **284** in FIG. 4B).

[0098]   Further improvement was conceived to simplify the system and method of transfer of data. The impetus behind this improvement was to find the least costly way to transfer non-trivial data between one or more remote locations and a primary facility where the data would be collected, stored, analyzed, or otherwise used. Low ongoing operational costs and low initial installation costs were key factors as was the ability to deploy the invention over a large geographical area. Several representative examples of the application of the concept are described here in addition to the container-monitoring applications described earlier.

[0099]   The concept is as follows: Information at one location will be communicated to another location by placing telephone calls to and from a remote site, which is identified by a unique telephone number, and a primary location having a quantity of unique telephone numbers. The initiating location of the data will be known to the receiver based on the telephone number used and the information itself will be encoded based on the telephone numbers called. By utilizing the information provided by the Caller ID system available in many countries of the world it is possible to communicate virtually any type of

data without incurring any telephone charges beyond the fees for the Caller ID service. This device and technique greatly improve on previous methods by defining a scalable process that is not limited to a few discrete conditions but can instead be implemented to transfer as many or as few data values as desired with fewer telephone circuits required at the primary location. Numerical data of any magnitude can be communicated with a maximum of ten incoming telephone lines and, as shown in Example "C", the complete set of ASCII characters may be transferred in a large system. Furthermore, the invention allows for bi-directional communication as opposed to the "transmission in the blind" approach described by the others.

[0100] FIGS. 3A1-3A2, 3B1-3B3 and 4A-C above have shown one possible electronic circuit that detects conditions in a container and provides the physical equipment needed to support the information transfer. The algorithms described in this improvement are readily useable on existing equipment such as is shown by these figures with only changes in the software to incorporate the new algorithms.

[0101] Examples are shown which represent a simple and a complex application of the invention. These demonstrate the scaleability of the invention and its ability to be adapted to a broad range of cost sensitive communications applications. It should be noted that this invention requires only that the Caller ID system uniquely identify the incoming call. Operation is not dependent on the use of any specific current or future telephone technology and it is equally applicable to conventional wired telephone systems,

wireless systems such as cellular telephones, or future undeveloped communications systems so long as the Caller ID information for the originating location is present on the incoming telephone signal.

[0102]   One example (A) is when an automated machinery at remote, unmanned locations needs to report a measurement whose value may range from 0 to 255 in whole integers, a common data size in modern data processing called a Byte. Telephones exist at the locations for use by service personnel, etc. Measurements from all locations need to be known at a central office.

[0103]   A primary location using the process algorithm described here could receive byte sized data messages from any number of remote locations using only two telephone lines equipped with ANI or Caller ID service. A system showing one remote location and a primary location is shown in FIG. 5.

[0104]   The data to be transferred is represented within the machinery's control system as a binary or base-2 number comprised of 8 digits with values of either 0 or 1. This representation is commonplace in computers and electronics worldwide. At the primary location, the receiving apparatus needs to be able to do a few basic things. 1) Detect an incoming telephone call; 2) Use the telco supplied Caller ID information to determine the location of the caller; and, 3) Determine which of only two required telephone

lines received the incoming call. Commercially available subscriber Caller ID equipment available for purchase or lease from many companies handles all these three items.

[0105]   Since a byte is comprised of 8 bits this system will require a total of eight calls, one for each bit, to be made to one of two telephone numbers. One number is called to represent a zero (0) bit and the other number is called to represent a one (1) bit.

[0106]   For purposes of our example let's say that the number to be called to indicate a bit value of zero is 111-222-0000 and the number to be called to indicate a bit value of one is 111-222-0001.

[0107]   With these facts in mind we are ready to encode the data, transmit it, receive it at the primary location, and decode it back into its original form.

[0108]   The order in which each of the eight bits are transmitted is unimportant so long as the sending order and decoding order compliment one another, i.e.—if the least significant bit is sent first then the receiver must decode in the same sequence. FIG 6 is a flowchart depicts a single bit or element of the data being encoded and transmitted.

[0109]   The value to be transmitted is 57 (base-10). The binary, or base-2 representation of 57 is 00111001. Eight calls will be placed to one of the two phone numbers. Those calls, in the order that they will be dialed are as follows:

1112220000

1112220000

1112220001

1112220001

1112220001

1112220000

1112220000

1112220001

[0110] It is important that the calls arrive in the correct order. When they are dialed if ringing is not detected then that number must be reattempted before other numbers are dialed. ANI or Caller ID information is sent to the dialed number just after the first ring. Once the sender has detected several rings the call is terminated and the next bit is processed. Note that we have purposely avoided waiting for the call we placed to be answered.

[0111] At the primary location where the data is to be received the Caller ID equipment signals the computer a call is being received from a specific phone number. This is depicted in the flowchart shown in FIG. 7. The system has been previously told that this number transmits 8-bit data using two phone numbers so it is expecting 8 incoming calls over some period of time referred to as the "watchdog time". As the equipment supplies each Caller ID message, the computer stores a record of each call along with the

identity of the caller and which line received the ring indication. This process is repeated

8 times to transfer our one byte value.

[0112]   If the 8 incoming calls are detected before the designated watchdog time has

elapsed the process moves on to finish decoding the data. Each bit of the byte is set to

a one (1) or a zero (0) based on which telephone line received the information. The actual

data transfer is complete at this point and the data may be stored or acted upon for

whatever purpose.

[0113]   Note that at this point the primary receiving location now has a non-trivial

piece of data that has been sent from a known remote location to a primary location

without the completion of a telephone call.

[0114]   Another example (B) occurs when the value of an electronic counter needs

to be transmitted from remote locations to a central office, and the value varies widely

depending on the activity at the location so that the values from 0 to 5,000,000 (five million)

must be accommodated.

[0115]   Although the technique for sending bytes of data described in Example "A"

could be expanded and used for values larger than a single byte there are time efficiencies

to be gained by changing techniques for larger value ranges. Sending the number

5,000,000 by encoding individual bits as telephone calls would require that 23 phone calls be placed.

[0116]   A more efficient configuration for larger values may be implemented using ten (10) telephone lines at the primary location. In this configuration we would assign each line to represent one decimal (base 10) digit for each value zero through nine (0 – 9.) For example, we might end up with ten phone numbers as shown here along with their corresponding meanings:

Telephone Number	Digit Represented
111-222-0000	Zero
111-222-0001	One
111-222-0002	Two
111-222-0003	Three
111-222-0004	Four
111-222-0005	Five
111-222-0006	Six
111-222-0007	Seven
111-222-0008	Eight
111-222-0009	Nine

[0117]   Due to our understanding of the data to be transmitted we know that it can take up to seven digits to represent the number 5,000,000. We will agree in the design of this system that leading zeroes are always transmitted. Thus, if the value to be sent were 718,235 the following sequence of telephone calls would be placed:

1112220000

1112220007

1112220001

1112220008

1112220002

1112220003

1112220005

[0118]   It is important that the calls arrive in the correct order. When they are dialed

if ringing is not detected then that number must be reattempted before other numbers are

dialed. ANI or Caller ID information is sent to the dialed number just after the first ring.

Once the sender has detected several rings the call is terminated and the next symbol is

processed. Note that we have purposely avoided waiting for the call we placed to be

answered.

[0119]   At the primary location where the data is to be received the Caller ID

equipment signals the computer a call is being received from a specific phone number.

The system has been previously told that this number transmits seven (7) digits of data

using ten phone numbers so it is expecting 7 incoming calls over some period of time

referred to as the "watchdog time". As the equipment supplies each Caller ID message,

the computer stores a record of each call along with the identity of the caller and which line

received the ring indication. This process is repeated 7 times to transfer our seven-digit value.

[0120]   If the seven incoming calls are detected before the designated watchdog time has elapsed the process moves on to finish decoding the data. Each digit of the seven-digit number is set to its decoded value zero (0) through nine (9) based on which telephone line received the information. The actual data transfer is complete at this point and the data may be stored or acted upon for whatever purpose.

[0121]   Note that once again, at this point the primary receiving location now has a non-trivial piece of data that has been sent from a known location and it has been sent and received without the need for the completion of any telephone call.

[0122]   Still further example (C) is considered wherein the sending of data from a remote site to a primary data collection location, the same basic techniques to achieve the data transfer are used but our implementation has been scaled up substantially. This example provides for the sending of messages of variable lengths that could include both numerical and textual information.

[0123]   The American Standard Code for Information Interchange (ASCII) is widely used by computer systems around the world and is in fact the "de facto" standard used to represent electronic information. The ASCII code provides for 255 unique character representations including the digits zero through nine, upper and lower case letters of the alphabet, common punctuation characters, and a series of non-printable characters that

facilitate data communication between computers. These ASCII values are found throughout common, readily available computer science literature and will not be described here.

[0124]   Expanding on Examples "A" and "B" if we want to be able to encode or decode the entire ASCII character set our primary computer location would need to be equipped with 255 telephone lines, one for each possible ASCII character. In the same manner as before, each line would have the same unique meaning to both sender and receiver.

[0125]   This example at its core is no more complicated than previous ones. One call is placed and detected for each symbol to be transferred. A feature added here is that we do not use messages or data of a fixed length.

[0126]   It is still a requirement that the primary computer know how many phone calls to expect. For purposes of this example let's say that the messages to be sent may be as long as fifty characters but some messages may be only ten characters.

[0127]   The requirement for the primary location to know how many calls to expect is readily met by the following agreement between remote and primary locations: The first two characters encoded and hence the calls received, will always indicate the total number of calls that are to be expected. Thus if we will send a ten character message a total of twelve calls will be made. The first two will indicate the digits one (1) and two (2), the

remaining ten will be the message being transferred. In this example the call count includes the two calls to specify the length. This is an arbitrary decision made by those implementing our process. The number of digits used to indicate the total message length may be any agreed upon value as required to accommodate the data or message.

[0128]   The remainder of the message encoding, transmitting, and decoding process follows the same pattern as the first two examples.

[0129]   A further example (D) is provided to a reverse data flow, i.e., from the primary location to one of the remote locations. Up to this point applications of our process have been demonstrated that provide the means to send data from a remote location to a primary location. Economies have been achieved by requiring multiple telephone lines at only the primary location while the remote location has only a single phone line that generates Caller ID information to the telephone company. This example demonstrates how data may also be sent from the primary location to a remote site without installing multiple lines at the remote.

[0130]   Two-way communication is made possible through the addition of equipment at the remote location that can decode incoming Caller ID information. If you refer back to Example "B", the primary location had ten phone lines that corresponded to the digits zero through nine. The remote already "knows" the correlation between digits and telephone numbers. It uses this information in the encoding process.

[0131]   By including algorithms at the remote location to recognize calls from any of

the ten phone numbers at the primary site and by providing the primary site with the ability

to also place outgoing calls, it is apparent that we can now send information from the

primary site to a specific remote.

[0132]   The primary site chooses which remote to contact by selecting the unique

telephone number associated with the remote location of interest. The data element to be

sent is determined by the primary location selecting which telephone line it will use to place

the phone call.

[0133]   The remote site will recognize an incoming call as coming from a number at

the primary site. It will determine the value or identity of the data element based on which

of the phone numbers was identified by the Caller ID system.

[0134]   In this example, as in the previous ones, we have again demonstrated that

our process is useful for transferring data between two locations without completing a

telephone call.

[0135]   Referring now to FIG. 8, the conserving means **68** of the transmitting module

18 is shown in a block diagram. The specific embodiment displayed is a slow timing circuit

72 (indicated by a dotted rectangular area) that only activates the transmitting module **18**

at periodic intervals. The slow timing circuit **72** comprises a counter **204** having an

oscillator **206** and an RC time constant **208**. The oscillator **206** preferably comprises a slow oscillator. The RC time constant controls the frequency of the slow oscillator 206, as shown by line **212**. The counter **204** triggers a one-shot circuit **214** within the slow timing circuit **72** when a pre-selected count is reached, shown by line **218**. The one-shot circuit **214** is only activated for 10 seconds so as to conserve energy. Thereafter, the one-shot circuit **214** turns on the first power source **50** of the transmitting module **18**, depicted by line **220**. The activated one-shot circuit **214** also resets the counter **204** back to its starting count, illustrated by line **222**. The most preferred counter **204** is a CD4060BCN counter, while the most preferred one-shot circuit **214** is a CD4538BCN one-shot circuit.

[0136]   FIG. 9 shows a flow diagram of the process of conserving the power level of the first power source **50**. A starting count **224** is initially set at zero. Then, step **226** shows that the counter **204** starts the count. Step **228** decides whether the pre-selected count has been reached. The most preferred pre-selected count set to five hours, but one of skill in the art will know that the pre-selected count is variable depending on one's preferences and needs. If the pre-selected count has not been reached, then the count continues, as shown by line **229a**. But, if the pre-selected count is reached, line **229b** shows that the next step **230** is to trigger the one-shot circuit **214** for 10 seconds. Once the one-shot circuit **214** is triggered, step **232** activates the first power source **50** of the transmitting module **18** and step **234** resets the counter **204** back to the starting count to start the process again, all within the 10 seconds of activation. In the manner described above, the power level of the first power source **50** is not continually used; rather, the first

power source **50** is only activated at periodic intervals for merely 10 seconds to run the transmitting module **18**. The transmitting module **18** uses the most power when it is transmitting data during this short time period. Otherwise, the conserving means causes the transmitting module **18** to "sleep" and not consume the power of the first power source **50**. This results in large monetary savings for the user and is also environmentally friendly.

[0137]   When the telephone line **146** of the base module **22** is not in use (on-hook), the modem **142** of the conveying means **134** will successfully be able to call the selected telephone number. But, if the telephone line **146** is already being used, or off-hook, the modem **142** will not be able to make a call on that line **146**. The problem of not knowing whether the telephone line **146** is on-hook or off-hook is solved by an off-hook detecting means **348** that is illustrated in a block diagram in FIG. 10. Referring to FIG. 10, the off-hook detecting means **348** detects when the telephone line **146** is in use and sends the off-hook information to the first microprocessor **86**, which does not allow the modem **142** to call the selected telephone number. Likewise, the off-hook detecting means **348** also detects when the telephone line **146** is on-hook and, thereby, sends this information to the first microprocessor **86** to allow the modem **142** to make the call.

[0138]   The preferred off-hook detecting means **348** comprises a plurality of diodes **350** connected to the telephone lines **146** leading, at one end, to a telephone jack **148** and, at another end, to a plurality of discrete circuits **352**. The discrete circuits **352** lead to an opto-isolator IC (opto-coupler IC) **354** that provides the first microprocessor **86** with the on-

hook and off-hook information. In a preferred embodiment of the off-hook detecting means **348** as shown in FIG. 10, the preferred diodes **350** comprise four diodes **350a-350d** in a full wave bridge configuration. The diodes **350a-350d** generate positive (+) and negative (-) voltage changes, whereby a positive voltage change represents that the telephone line **146** is on-hook and a negative voltage change represents that the telephone line **146** is off-hook. The preferred discrete circuits **352** comprise a first discrete circuit **352a** and a second discrete circuit **352b**, whereby the first discrete circuit **352a** detects the positive or negative voltage change from the diodes **350a-350d** and relays that information to the second discrete circuit **352b**. The second discrete circuit **352b**, then, becomes activated and further relays the on-hook/off-hook information to the opto-isolator IC **354**. The opto-isolator IC **354** preferably comprises an LED **357** and a phototransistor **358**. The LED **357** is lit when the telephone line **146** is off-hook and dim when on-hook. Once the information passes through the LED **357** , it is sent to the phototransistor **358** that is light-activated and relays the information from the LED **174** to the first microprocessor **86**. The first microprocessor **86** will, therefore, be informed as to whether the telephone line **146** is on- or off-hook.

[0139]   This invention has great utility in the waste disposal industry, but it may also be useful in other industries where remote containers or locations need to be monitored. Hence, while the invention has been described in connection with a preferred embodiment, it will be understood that it is not intended that the invention be limited to that embodiment.

On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as disclosed.

[0140]   As to the manner of usage and operation of the instant invention, same should be apparent from the above disclosure, and accordingly no further discussion relevant to the manner of usage and operation of the instant invention shall be provided.

[0141]   With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

[0142]   Therefore, the foregoing is considered illustrative of only the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.